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PATENT APPLICATION

for

PIPETTE TIP PACKAGING AND TRANSFER SYSTEM

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PIPETTE TIP PACKAGING AND TRANSFER SYSTEM

BACKGROUND OF THE INVENTION

By 5 Priority Claim: Under the provisions of 35 U.S.C. § 1.19(e), priority is claimed from Provisional Patent Application 60/066,773 filed November 24, 1998. ^{§ 1.19(e)} ¹⁹⁹⁸

Field of Invention: The present invention relates generally to a packaging and transfer system for disposable pipette tips. In particular, the present invention relates to an improve packaging and transfer system for pipette tips.

10 State of the Art: Medical and research laboratories are called upon to perform large numbers of repetitive tests. For example, large quantities of routine blood tests may be performed by a laboratory technician at one time. Samples of the blood in test tubes may be arranged in an array to facilitate speed in performance of the tests. For example, the test tubes may be arranged on a rack eight tubes wide by twelve tubes
15 deep. Specific chemical or biological materials are then added to each tube in like amounts as a part of the testing process. This is typically accomplished by drawing in and subsequently injecting the chemical or biological material through a pipette tip that is attached to a pipette tool.

20 For testing of arrays of test tubes, multi-site pipette tools are provided that can hold multiple pipette tips. That is, manufactures of pipette tips provide them on trays or racks in an array (see U.S. Patent 3,853,217 (Scordato); U.S. Patent 5,324,482 (Scaramella, et al)) so that a multi-site pipette tool may easily register with sets of pipette tips. The pipette tips are typically thrown away after use.

25 The disposable pipette tips are typically supplied in trays which have openings for receiving 96 pipette tips. Typically, each of these trays is packaged in an outer box; and both the box and trays are discarded once the tips have been used. These trays take up a substantial amounts of space and utilize a large amount of packaging material which must be discarded. To eliminate this problem, empty trays are sometimes refilled by hand with a new set of pipette tips. However, due to the tedious

and time-consuming nature of this process, empty trays are most often discarded, which further increases waste materials particularly with an increasing volume of testing.

U.S. Patent 5,324,482 (Scaramella, et al.) shows a system for storing pipette tips. It uses an alignment plate that is attached to a transfer card by a locking
5 mechanism. The pipette tips are stored on the transfer card; and a stack of transfer cards with pipette tips are positioned in a box for transport and sale along with an alignment plate. Although reducing the number of empty trays and other disposable material, the locking mechanism is hard to operate and costly.

Thus, the laboratories and other testing facilities have a need for an inexpensive
10 pipette tip packaging, storage, and transfer system that permits storage of pipette tips within a container of compact size in order to reduce the amount of storage space needed to stock the pipette tips and to further reduce the amount of packaging material used and thrown away. Furthermore, a need exists for a pipette tip storage and transfer system that is easy simple and easy to use to facilitate transfer of pipette tips from a
15 storage container to a holding tray without requiring latching mechanisms or other moving parts.

BRIEF SUMMARY OF THE INVENTION

20 The present invention relates to a new and improved pipette tip packaging and transfer system which takes up a small amount of space so as to limit or minimize the amount of packaging materials and waste produced in comparison to many other systems that provide a similar number of pipette tips. The system utilizes a minimal number of moving and interacting parts, which makes it easy to use and inexpensive to
25 manufacture in relation to other similar storage and transfer systems known in the art. The pipette tip packaging and transfer system comprises a plurality of receiving plates, each plate having a plurality of openings for receiving pipette tips in a substantially vertical alignment at a medial position thereof. The loaded receiving plates can be stacked one atop of another with the pipette tips contained within a first receiving plate

being received in the top openings of the aligned pipette tips contained within the underlying receiving plate of the stack. A container is provided to securely hold the stack of receiving plates.

In a preferred embodiment of the invention, a transfer member or plate having comparable dimensions to those of the receiving plate is provided. A plurality of projections extend from the bottom surface of the transfer member at positions that correspond to the location of the openings of the receiving plate. The projections are configured and arranged to extend into the top openings of the pipette tips on the upper-most receiving plate and maintain the pipette tips in a fixed and substantially perpendicular alignment in relation to the transfer member and receiving plate. The pipette tip packaging and transfer system can further include a container or box which is sized to receive and securely hold the receiving plate, the transfer member, and the pipette tips contained within the receiving plate and the transfer member, and also includes a lid sized to fit over the container or box. The container includes front, back, and side walls, all or some of which include cut outs thereon that enable a user to grab and lift each receiving plate, from the stack of receiving plates located within the container, with the transfer member.

With the pipette tip packaging and transfer system of the present invention, an empty pipette tip holding tray can be quickly and easily refilled. To do so, the user simply grasps the upper-most receiving plate and the transfer member with his/her index finger and thumb and lifts the same out of the container or box. The pipette tips are then inserted into the pipette tip holding tray by aligning distal ends of the pipette tips located within the receiving plate with the openings in the pipette tip holding tray and lowering the receiving plate and attached transfer member into the pipette tip holding tray until the pipette tips are engaged in the tray openings. The transfer member is then lifted away from the pipette tip openings, leaving the receiving plate resting on the holding tray and the pipette tips resting within the tray openings. The transfer member is then placed over the next uppermost receiving plate in the stack within the container, making sure to insert the protrusions extending from the bottom

surface of the transfer plate into the openings of the pipette tips located within the uppermost receiving plate. This final step prepares the pipette tip packaging and transfer system for the next transfer and refill procedure.

Alternatively, the pipette tips located within the upper most receiving plate in the container may be directly dispensed from the upper most receiving plate in the stack of the container or box. Thus, the need to transfer of the pipette tips into a pipette holding tray is eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctively claiming that which has been regarded as the present invention, the advantages of this invention can be more readily ascertained from the following description of the invention when read in conjunction with the accompanying drawings in which:

FIG. 1 is a top plan view of a receiving plate which forms part of the pipette tip packaging and transferring system according to a preferred embodiment of the invention;

FIG. 2 is a cross-sectional view taken along line 2-2 of FIG. 1, illustrating the receiving plate with several pipette tips positioned within the holes of the receiving plate;

FIG. 3 is a cross-sectional view of a transfer member of the pipette tip packaging and transfer system according to a preferred embodiment of the invention;

FIG. 4 is a cross-sectional view of the receiving plate, transfer member, and pipette tips located there between, forming the main parts of a preferred pipette tip packaging and transfer system according to the present invention;

FIG. 5 is an enlarged sectional view of the receiving plate, a pipette tip, and a first embodiment of a transfer member according to the present invention;

FIG. 6 is an enlarged sectional view of the receiving plate, a pipette tip, and a second embodiment of the transfer member of the present invention;

FIG. 7 is a side elevational view of a container and lid forming a part of the packaging and transfer system;

5 FIG. 8 is a cross-sectional view taken along line 8-8 of FIG. 7;

FIG. 9 is a top plan view of a pipette tip holding tray for dispensing pipette tip; and

FIG. 10 is a cross-sectional view taken along line 10-10 of FIG. 9.

10 DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a receiving plate 20 is shown, which either alone or in combination with other such receiving plates form a preferred embodiment of a pipette tip packaging and transfer system of the present invention. Each receiving plate 20 has a substantially rectangular shape and includes a rectangular array of ninety-six (96) openings 22 for receiving pipette tips 26, as further illustrated in FIG. 2.

15 Although the preferred embodiment includes a rectangular array with ninety-six (96) openings 22, it is understood that receiving plate 20 can include any number of openings 22 located at any suitable configuration which matches the configuration of corresponding openings located on a pipette tip holding tray, as described below in conjunction with FIGS. 9 and 10. Each opening 22 is sized and shaped to permit a distal portion of each pipette tip to be inserted vertically through openings 22 and held in position at a proximal portion 28 of pipette tips 24. Thus, the outer periphery of openings 22 are less than the pipette tip diameter at proximal portion 28 of each pipette tip 24.

20 FIGS. 9 and 10, show a holder tray 78 which is typically configured to hold 96 pipette tips. When ten such systems (i.e., 960 pipette tips) are needed, ten complete pipette tip holding trays must be stacked one on top of another. There is a significant amount of dead space that results. Further, upon use of the pipette tips, the trays such as tray 78 are excess and thrown away.

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In the present system, the holding tray 70 is reused as often as desired to act as a rack into which pipette tips are placed using a receiving ~~plate 20~~ ^{Plate 20, the Plate 20}. The ~~plate 10~~ with pipette tips is transferred to the holding tray 70 using the transfer tool as hereinafter discussed. In use, a plurality of receiving plates 20 may be stacked one on top of another by aligning a distal end 29 of each pipette tip 24 with the underlying and corresponding pipette tip opening 26 located at a proximal end 28 of pipette tip 24. In this manner, a plurality of the pipette tips 24 may be stacked and stored in a minimal amount of space until needed. Upon transfer the holding tray 70, the pipette tips can be accessed using a multi-site pipette tool. When all the pipette tips are used all that remains is the initial box and the receiving plates 20.

Referring to FIG. 3, a transfer member 30 that comprises a second portion of the pipette tip packaging and transfer system of the present invention is shown. Transfer member 30 comprises a flat rectangular plate 32 having dimensions that substantially match those of receiving plate 20. A plurality of projections or bosses 34 are attached to a bottom surface 31 of rectangular plate 32 to extend away therefrom a distance 33 selected to facilitate connection and stable alignment of the pipette tips 24. The bosses 34 are dimensioned and arranged to match openings 22 of receiving plate 20 and openings 72 located in a conventional pipette tip holding tray 70 described below in conjunction with FIGS. 9 and 10. That is, a boss 34 is provided to register with each pipette tip in the illustrated embodiment. In some applications, it may be available to have a transfer member 30 with bosses 34 around the outer periphery 37 of the rectangular plate 32. That is portions of the array of bosses 34 toward the center of the transfer member 30 may be eliminated to save cost in materials and in tooling. The bosses 34 and the openings 22 are in axial alignment 35 when the transfer member 30 is positioned to align the bosses 34 with the proximal ends 28 of the pipette tips 24.

As further detailed below in relation to FIGS. 5 and 6, projections or bosses 34 are designed to snugly fit and engage in the top opening 26 of each pipette tip 24 supported or positioned in receiving plate 20. The bosses 34 function to maintain the

pipette tips 24 in a substantially vertical orientation within receiving plate 20 so that the pipette tips may be easily placed into the holding tray 70.

FIG. 4 illustrates a storage and transfer portion of the pipette tip packaging and transfer system of the present invention, including receiving plate 20 and transfer member 30. As shown, pipette tips 24 can be stacked vertically atop of one another by introducing pipette tips 24 into receiving plate 20 and aligning the distal tip 29 of each pipette tip 24 over and into top openings 26 of pipette tips 24 located in an underlying receiving plate 20. A first assembly 21 consisting of the uppermost receiving plate 20A and pipette tips 24A is formed. Receiving plates 20B and 20C are each formed into assemblies 23 and 25 respectively by placing pipette tips 24A into pipette tips 20B. The assemblies 21, 23, and 25 are then all stacked as shown. When stacked, the bottom surface 27 of receiving plate 20 rests on the shoulder 29 (FIG. 5) above the annular portions 39 of proximal portion 28 which are formed to have top opening 26. In this fashion, multiple stacks of pipette tips 24 contained within receiving plate 20 can be stacked vertically to form a compact assembly of pipette tips 24 when those holding trays are stacked atop of one another. Stabilization of the pipette tips 24 during the alignment and stacking process is accomplished by first lowering transfer member 30 onto the proximal end 28 of each pipette tip 24, such that each projection or bosses 34 on transfer member 30 is inserted into top openings 26 of pipette tips 24.

FIGS. 5 and 6 illustrate two preferred embodiments of the transfer member projections engaged to a pipette tip on a receiving plate. In FIG. 5, a projection or bosses 44 having a substantially uniform cross-section or diameter throughout its length 43 is illustrated. Even though the bosses 44 is shown to be essentially cylindrical in form, it should be understood that projection or bosses 44 may be of a variety of suitable lengths, widths, diameters and shapes. Indeed, the bosses may even be tapered from the surface 31 toward the distal end 45 so that entry of the bosses 44 into the opening 26 is facilitated and will yield a snug fit along its length 43. That is the bosses 44 is shaped to snugly register in the aperture 26 so that the diameter 47 of projection 44 is preferably equal to or slightly less than the diameter of the aperture 26.

Projection or bosses 44 is preferably sized in length to hold pipette tip 24 in a substantially immobile position generally normal to the undersurface 31. In other words, projection or bosses 44 maintains pipette tip 24 in a substantially perpendicular alignment in relation to transfer member 30. In practice it has been found that the
5 bosses 44 is sized in length 43 to extend into the aperture 26 at least half the depth 51 of the aperture 26 or the length of the upper portion 28 of the pipette tip 24. Lengths 43 from about half to the entire depth 51 of the aperture 26 are acceptable.

FIG. 6 illustrates a second preferred embodiment of transfer member 30 that has a tapered projection or bosses 46 which tapers from the undersurface 31 to its distal end
10 53. The narrowing configuration of tapered projection 46 permits positioning of projection 46 further or deeper into lumen 48 of the aperture 26 of pipette tip 24 to provide greater stability of pipette tip 24 relative to transfer member 30.

Advantageously, tapered projection 46 may be sized and shaped so as to permit contact between the distal end 53 of projection 46 and the inner wall 55 defining lumen 48, and
15 to provide further contact between an uppermost portion of projection 46 and the mouth 57 of the opening 26. Although numerous sizes and configurations are envisioned, tapered projection 46 preferably has a length 59 in excess of half the distance 51 of the upper portion 28 to substantially immobilize and hold pipette tip 24 in a substantially perpendicular alignment with respect to the surface 31 of transfer member 30.

20 Additionally, the surface 61 of tapered projection 46 is preferably sized and shaped to engage a maximum possible surface area of the inner wall 55 defining lumens 48 and 50 of pipette tip 24.

FIGS. 7 and 8 illustrate a complete pipette tip packaging and transfer system, including all of the parts previously illustrated in FIGS. 1-4. As illustrated in FIG. 7, a
25 container 50 is provided for storing a stack 66 of receiving plates 24 and pipette tips 20. Container 50 includes a rectangular base 56, side walls 52, and end walls 54. Container 50 is configured to receive stack 66 in a snugly-sliding fit. Each of side walls 52 include a cut out portion 64 that provides access for grasping and lifting each receiving plate 20 and transfer member 30. A support member 68 is attached to and

extends along the center of base 56 for elevating the lowermost receiving plate 20 of stack 66 such that the distal end 29 of pipette tips 24 contained therein are sufficiently raised so as to prevent contact of pipette tips 24 with the inner surface of base 56, as illustrated in FIGS. 7 and 8.

5 To operate the pipette tip packaging and transfer system of the present invention, transfer member 30 is urged ^{downward} onto the uppermost receiving plate 20 of stack 66 by aligning projections 34 and engaging the same in the top opening 26 of each pipette tip 24 contained in the uppermost receiving plate 20. The operator then grasps the opposing sides of both member 30, typically using a thumb 63 (shown in phantom in FIG. 8) and index finger, and lifts the uppermost receiving plate 20 and transfer member 30 from container 50. With receiving plate 20 and transfer member 30 firmly grasped by the user between thumb and forefinger, the distal ends 29 of pipette tips 24 are aligned with openings 72 located in an upper wall 76 of pipette holding tray 70 (FIGS. 9 and 10) and lowered onto upper wall 76 so that distal ends 29 of pipette tips 24 extend through opening 72 and so that the lower surface 27 of receiving plate 20 lies on upper wall 65 of holding tray 70, as illustrated in FIG. 10. The user then releases the sides of receiving plate 20 and lifts transfer member 30 upwardly away from holding tray 70, thus removing each projection 34 of transfer member 30 from top opening 26 of each pipette tip 24, leaving pipette tips 24 ready for use in holding tray 70. When all the pipette tips 24 are used, the receiving plate 20 may be removed and discarded or recycled.

When all the pipette tips on the holding tray 70 are used, transfer member 30 is then once again lowered onto the pipette tips 24 of the next uppermost receiving plate 20 by aligning projections 34 of transfer member 30 with top opening 26 of each pipette tip 24. In this fashion, holding tray 70 can be refilled with pipette tips 24 repeatedly in a simple and quick manner.